Tugarinovite $Mo^{4+}O_2$

Crystal Data: Monoclinic. *Point Group:* $2/m$. As crystals, prismatic to thick tabular, striated ‖ length, subangular, to 1.5 mm. *Twinning:* Typical, polysynthetic, on an unknown law.

Physical Properties: Hardness = 4.6 VHN = 300 (20 g load). D(meas.) = n.d. D(calc.) = 6.58

Optical Properties: Semitransparent. *Color:* Dark lilac-brown. *Streak:* Greenish gray. *Luster:* Greasy to metallic.
Optical Class: Biaxial. *Anisotropism:* Light gray to dark pink; pale yellow to bluish olive-brown. *Bireflectance:* Observed.
R_1–R_2: (440) 16.8–27.5, (460) 15.5–24.9, (480) 14.9–23.1, (500) 14.6–21.7, (520) 14.5–20.9, (540) 14.7–20.3, (560) 16.2–19.9, (580) 19.7–18.7, (600) 21.3–19.6, (620) 24.6–19.6, (640) 27.6–19.9, (660) 30.7–19.6, (680) 33.9–21.7, (700) 37.2–23.2

Cell Data: *Space Group:* $[P2_1/c]$ (by analogy to synthetic material). $a = 5.59(1)$ $b = 4.82(1)$ $c = 5.51(1)$ $\beta = 119°32'$ Z = 4

X-ray Powder Pattern: Lenskoye Mo–U deposit, Russia.
3.391 (100), 2.412 (8), 1.703 (8), 1.716 (6), 1.398 (6), 1.077 (5), 2.388 (4)

Chemistry: (1) Lenskoye Mo–U deposit, Russia; by electron microprobe, average of five analyses MoO_2 99.86%, with traces of Fe, Ti, Ca, Si.

Occurrence: Formed as a primary mineral, by metasomatism in a reducing environment deficient in sulfur.

Association: Uraninite, molybdenite, galena, zircon, wulfenite.

Distribution: From the Lenskoye Mo–U deposit, Amur district, eastern Siberia, Russia.

Name: For Aleksei Ivanovich Tugarinov (1917–1977), geochemist, Moscow University, Moscow, Russia.

Type Material: A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 81395.

References: (1) Kruglova, V.G., A.A. Poteryaikina, G.A. Sidorenko, L.S. Dubakina, and Y.G. Ryabeva (1980) Tugarinovite (MoO_2) – a new hypogene molybdenum mineral. Zap. Vses. Mineral. Obshch., 109, 465–468 (in Russian). (2) (1981) Amer. Mineral., 66, 438–439 (abs. ref. 1). (3) Kruglova, V.G., G.A. Sidorenko, Y.G. Ryabeva, A.A. Poteryaikina, and L.S. Dubakina (1984) New data on tugarinovite. Doklady Acad. Nauk SSSR, 264, 689–693 (in Russian). (4) Bolzan, A.A., B.J. Kennedy, and C.J. Howard (1995) Neutron powder diffraction study of molybdenum and tungsten dioxides. Aust. J. Chem., 48, 1473–1477.